

OWNER'S MANUAL

leonardoTM



Chess Computer

Schachcomputer

Jeux d'échecs électroniques

Schaakcomputer

KASPAROVTM
CHESS COMPUTER



Swiss-led
Precision



C/AM 2 / R14

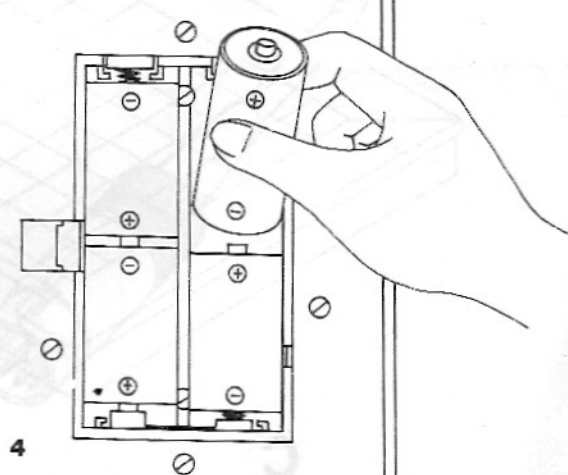
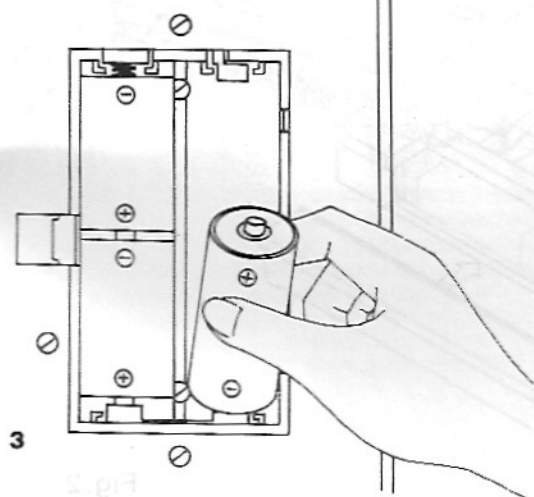
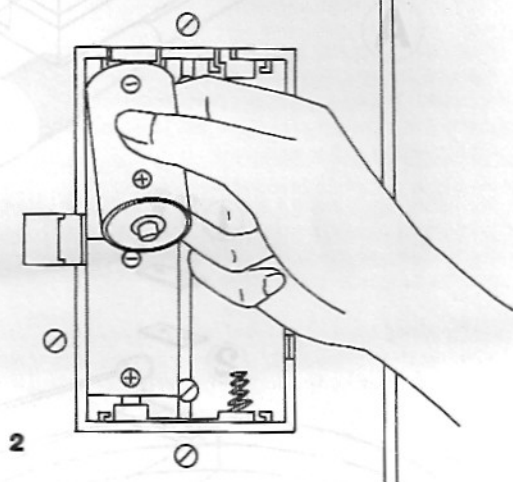
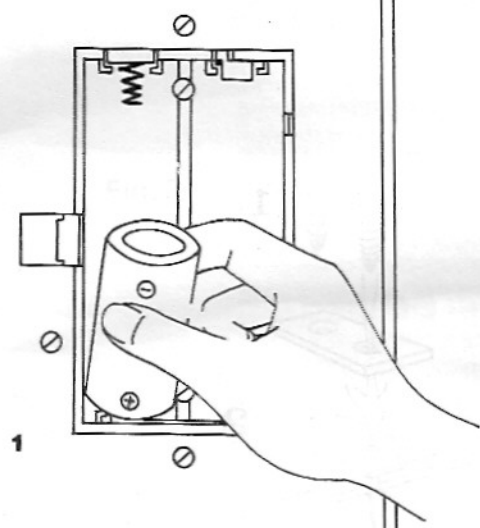


Fig.1

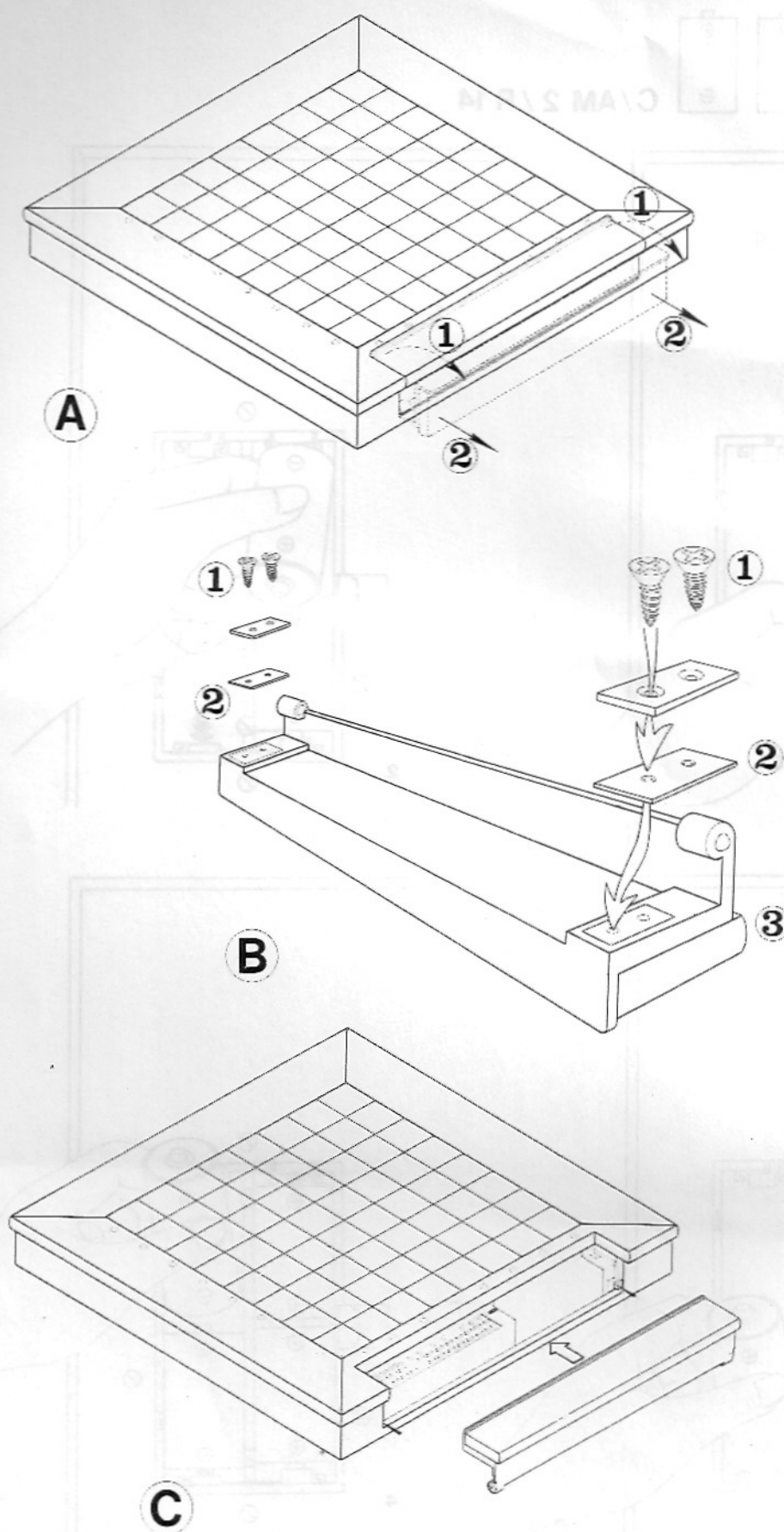


Fig.2

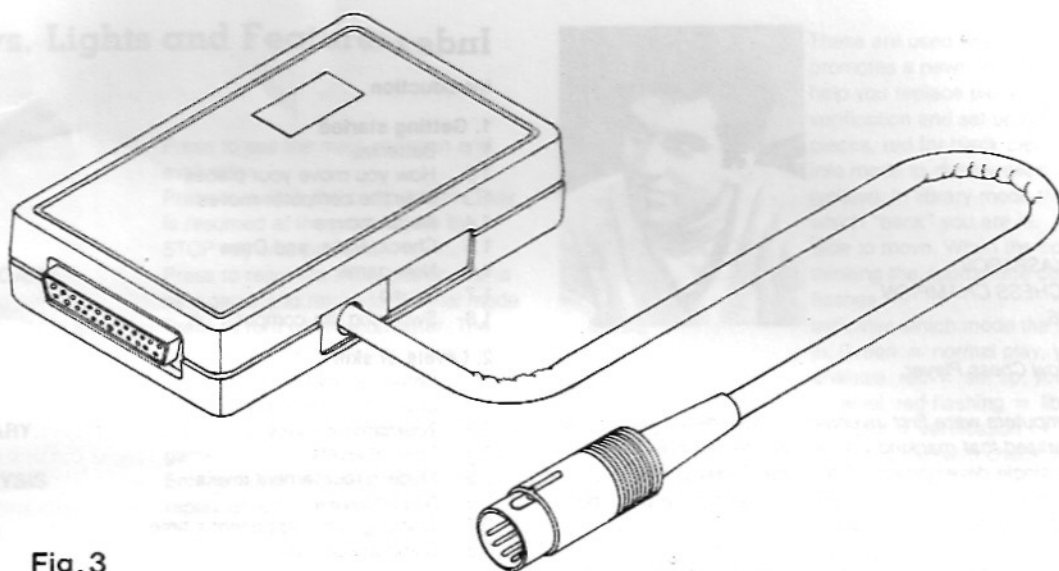


Fig. 3

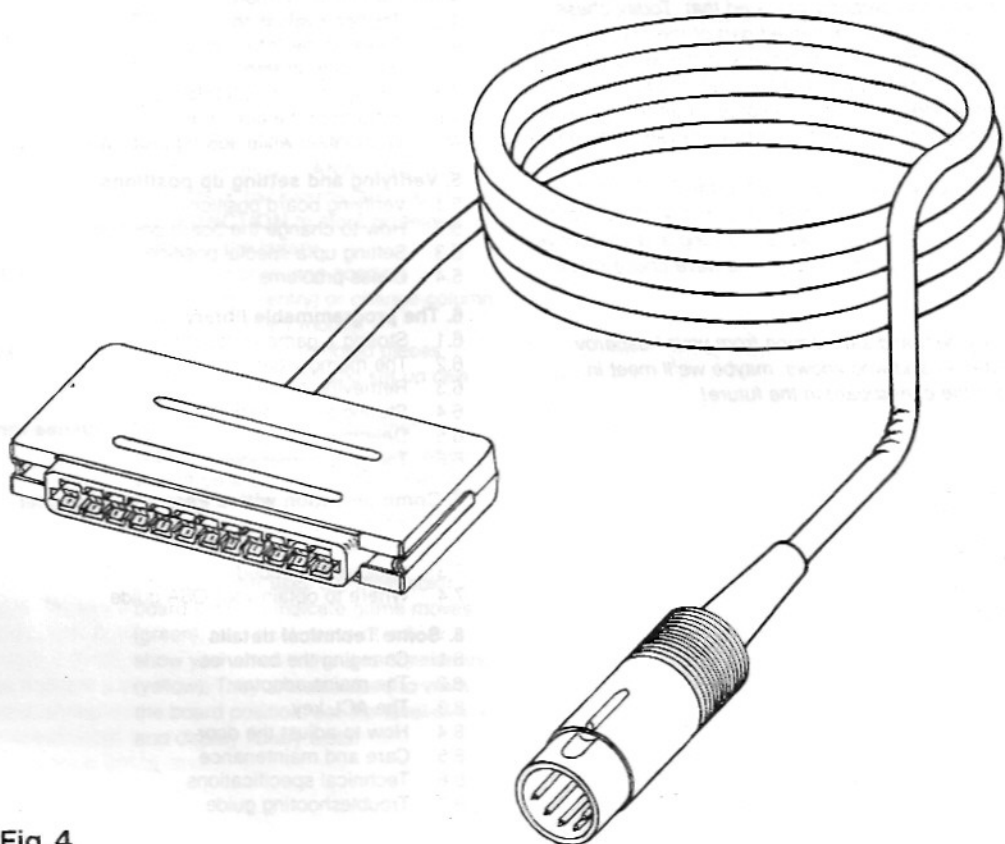


Fig. 4

GARRY KASPAROV
WORLD CHESS CHAMPION
June 1986



Dear Fellow Chess Player,

When computers were first invented just four decades ago few people realized that mankind was witness to the most important single development of our time. Today computers have become freely available and in a few years there will be a computer in almost every household.

SciSys has asked me to write a few words to welcome you to the world of chess playing computers. I have been personally associated with the company since 1983 and can therefore speak about its products from experience.

Until recently chess computers were regarded as simple toys which would never be capable of providing serious opposition for the enthusiast. The rapid advance of technology and programming skills has certainly changed that. Today chess computers have become an accepted part of the chess world, serving not only to introduce new players to the world's finest game but also encouraging them to take part in tournaments against human opponents. Chess computers can teach you all the basics of the game and keep up with you even if you go on to become a top club player.

SciSys, a Swiss-led company, has been at the forefront of this development and has been responsible for many of the most interesting innovations. I look forward to a long and productive relationship with SciSys and with you who have chosen their computers.

I wish you enjoyment and satisfaction from your Kasparov chess computer — and who knows, maybe we'll meet in combat across the chessboard in the future!

Good luck!

Garry Kasparov

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Keys, Lights and Features

Keys

INFO	Press to see the main variation and evaluation
GO	Press to switch the computer on. Play is resumed at the point where the STOP key was pressed
NEW GAME	Press to reset the initial position for a new game and return to Normal mode
STOP	Press to turn off the computer. The current position is stored in memory
SET UP	Enter set up mode (to change or enter positions)
LIBRARY	Enter library mode (to store or retrieve games)
ANALYSIS	Enter analysis mode (to take back, replay or enter moves)
LEVEL	Enter level mode (to select level of skill)
NORMAL	Return from special mode (analysis, set up, level, library) to normal play
PLAY	Execute next move. Pressing this key when it is your turn causes the computer to play the next move for you, pressing it when the computer is thinking interrupts the thought process. Computer returns to Normal mode.
SOUND FUNCTION	Press to turn sound off or on
⊕ ⊖	"2nd Function" key. Pressing this key alters the meaning of the next keypress
TAB/COLOR	Used to increment or decrement level setting. Info display, library slots. Also used together with ANALYSIS to play forwards or backwards, and together with FUNCTION to store or delete games in the library.
Piece keys	Change color (during position verification or entry) or change column (in level or library mode).
Chessboard sensor	Used to choose promoted pieces, verify board position and set up new positions
	Each square has a sensor that registers piece movement (i.e. when you lift up a piece or put it down on a square)

Lights

Board lights	The computer uses the triple-color board lights to indicate game moves (green), take back moves (red), or show you which move it is considering (yellow). They are also used to verify the board position, set the level of skill and display library slots.
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Piece lights

These are used when the computer promotes a pawn, during takeback (to help you replace pieces), position verification and set up (green for white pieces, red for black pieces), and in info mode to display depth of search (yellow). In library mode they indicate which "bank" you are in.

WHITE — BLACK

Side to move. When the computer is thinking the appropriate color light flashes

MODE

Indicates which mode the computer is in: Green = normal play, yellow = analysis, red = set up, yellow flashing = level, red flashing = library, green flashing = verification

END

End of game (with check = checkmate)

CHECK

King in check

COMM.

Indicates that the communication link between Leonardo and a personal computer is open.

MODULE

Indicates that an upgrade module is fitted and available for use.

Features

- ACL hole to the right of the keyboard.
- Socket for mains adapter (underneath)
- OSA Link (underneath)
- Battery compartment (underneath)

Introduction

Your Leonardo is one of the most advanced chess computers in the world. It is made of high-grade wood and it has a full tournament-size playing surface. Each square contains a sensor which can detect the presence of a piece on it — which means that you can play your moves exactly like you do in a normal game of chess.

Leonardo has a number of very exciting features that are designed to increase your total enjoyment of the game. It has 32 levels of skill, including special levels for tournament chess, speed games, analysis, problem solving, etc. You can take back any number of moves, replay the entire game, or watch the computer analyze a position while it is computing a move. If you need help at any time during the game Leonardo is always prepared to suggest a move for you.

There are also some features that are quite unique in the chess computer world. A good example is the "User-Programmable Library" in which you can store dozens of games permanently in the computer's memory. You can also use it to program the computer with your favourite openings, adding these to Leonardo's already comprehensive openings library.

Apart from this, Leonardo is the world's first computer with "Open System Architecture", known as **OSA**. This means that new state-of-the-art programs can be easily made available as modules in the future, ensuring that the computer will never be outdated. Some powerful new modules are already available (consult your dealer) and can be simply slotted into the computer in a few seconds. **OSA** also allows you to connect Leonardo to a standard printer or personal computer so that you can print out games or store them on disk. Talented amateurs can even write their own chess programs and use **OSA** to run them on Leonardo!

In spite of all these advanced features, you will find Leonardo especially easy to use. Before you begin to play with it you should, however, read at least Chapter 1 of this manual. It tells you all you need to know for normal games of chess. If you wish to make the computer play at a different speed then you must go on to Chapter 2, which tells you all about the 32 levels of skill and how to select them. Chapter 3 deals with some very useful features built into the computer, and Chapter 4 tells you about the information you can get from the computer during a game. In Chapter 5 you will learn how to verify and set up chess positions, while Chapter 6 is devoted entirely to the user-programmable library. Chapter 7, finally, tells you how your Leonardo can be connected with a personal computer and gives some examples of how versatile and useful this can be.

We hope that you will have many years of enjoyment with your Leonardo, which is a truly timeless chess machine.

Important note: Leonardo has been programmed to play chess with you. It knows all the rules of the game, including castling, en passant, underpromotion, stalemate and draw by threefold repetition or the 50 move rule. Sometimes the computer may appear to be playing irregularly when in fact it

is obeying these rules. In case you are not very familiar with the game we have included a copy of the rules of Chess. If you need additional information your local library is sure to have several books on the subject.

1. Getting started

1.1 Batteries

Your Leonardo runs on four AM2, R14 or "C" size batteries or you can also use the SciSys mains adapter. Open the battery compartment and insert the batteries as shown in Fig. 1. The computer will conduct a quick self-test of all electronic components, after which it is ready to play chess against you.

Note: If the computer fails to respond — static discharge can sometimes cause it to lock up — use a paper clip or a piece of stiff wire to press and hold the ACL switch located at the right of the keyboard for 1 second to reset the computer.

1.2 How you move your pieces

Once you have inserted the batteries you are ready for your first game of chess against Leonardo. Set up the pieces in the opening position with the white pieces nearest to you. Press **NEW GAME** (you should always do this at the beginning of a game).

Captures require you to lift away the captured piece before putting down the capturing one.

To make a move first lift up the piece you wish to move. Place the piece on its destination square. You will hear a short beep. The **BLACK** light will begin to flash. This means that the computer has accepted your move and has started to compute a reply for Black.

Note: At the beginning of a game the reply will usually be instantaneous on any level because Leonardo is playing moves that are stored in its "opening book".

In case of an en passant capture Leonardo will remind you to remove the captured pawn. When castling always move the king first. The computer will remind you to move the rook.

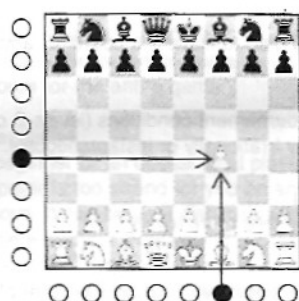
When a pawn promotes it is automatically changed into a queen. If you wish to "underpromote", do so in the following manner: First lift up the pawn (which must be on the 7th rank) and remove it from the board. Now press a piece key (rook, bishop or knight) to tell the computer which piece you choose, and finally place the piece you have chosen on the promotion square. (When Leonardo promotes a pawn it will always tell you which piece it chooses by turning on one of the piece lights during the move).

1.3 How the computer moves

Whenever the Leonardo wants to make a move, it sounds a high double beep and turns on two lights on the side of the chessboard (the "board lights"). These lights indicate the horizontal row and vertical column of the piece it wishes to move. Lift up this piece. The computer will now show you where the piece must go. Move the piece to the square indicated.



The computer wants to move this piece. Lift it up.



This is where the piece must go. Place it on the square.

Note that the board lights are green when you are playing a normal game. We will see later that they turn red when you are taking back moves and yellow when the computer is giving you an insight into its thought process.

1.4 Illegal moves

If you attempt to make an illegal move, the computer will not accept your move. Instead it will keep flashing the square you have just moved. Lift it up and the board lights will tell you where the piece came from. Replace it on the square indicated. If you do not execute a computer move correctly it will sound a low error beep to indicate that you are trying to move the wrong piece (or are moving it to the wrong square). Watch the board lights carefully and move the piece correctly.

1.5 Check, Mate, and Draw

When the computer puts your king into check, the CHECK light will come on. If a game ends in checkmate the END light will come on as well and you will hear the characteristic end-of-game signal (high-high-low-low). The WHITE or BLACK light tells you which side has been checkmated.

The computer may announce a forced mate many moves before it actually occurs. You will hear the end-of-game signal and one of the piece lights 1 to 6 will turn on (yellow), telling you how many moves there are to mate. If the computer is announcing a mate in more than six moves, then it will flash light number 6.

If a game ends in a draw then you will hear the end-of-game signal, and only the END light will be turned on. The computer knows three kinds of draws:

draw by stalemate — the side to move is not in check and has no legal move;

draw by threefold repetition — a position has occurred three times in the game;

draw by the fifty-move-rule — there has been no capture or pawn advance during the last fifty moves.

1.6 New game

To start a new game simply press **NEW GAME**. You will hear the new game signal (low-high-low-high). You can interrupt a game at any stage by pressing **NEW GAME** — so be careful not to press it by mistake.

You may also start a new game by placing all the pieces in the initial position. Leonardo will sound the new game signal and prepare for a new game.

1.7 Sound

If the computer's "beeps" are distracting you or others during a game, you may turn off the sound by pressing **SOUND**. Pressing the key again will turn it back on (you will hear a double beep to confirm this). You must watch the indicator lights and move pieces and press keys carefully when playing without sound.

1.8 Switching off

To turn the computer off just press the key marked **STOP**. This is a so-called "soft switch" which you may use at any time, even when the computer is thinking. If you press **GO** the computer will come back to life and continue exactly where it left off. You should use **STOP** whenever you interrupt a game for more than a few minutes, as this will conserve battery power.

If you are using fresh batteries the computer will retain the current position (and game) for up to two years.

2. Levels of skill

Your Leonardo has a total of 32 different levels of skill (modules add additional levels). They include levels for casual play, tournaments, speed chess, analysis, problem solving and eight special junior levels for beginners. Remember that just like a human being the computer becomes stronger when it has more time to think about its moves.

2.1 Setting a level

When you first switch on the computer, level A1 is automatically set. You may verify this by pressing **LEVEL**. The **MODE** light will begin to flash yellow, indicating that you are in level mode, and two board lights (red) will point to the square A1, which is the level currently set.

To change the level press the key marked $\oplus$. The board lights will now point to the square A2. Keep pressing $\oplus$ and you will see that all squares from A1 to D8 are successively indicated. The $\ominus$ key reverses the direction.

There is one more key to help you change levels. Try pressing **TAB/COLOR** in level mode. This moves the level setting across between the columns (e.g. from A1 to B1). Using $\oplus$, $\ominus$ and **TAB/COLOR** you can reach any level very quickly.

You may change the level at the beginning or at any time during a game. Once you have reached the level you want, press **NORMAL** to return to normal play (the **MODE** light turns green). The new level setting remains unchanged even if you press **NEW GAME**.

2.2 Levels for casual play

The first eight levels are designed for casual play and the average response time on each level is as follows:

A1	1 second per move
A2	2 seconds per move
A3	5 seconds per move
A4	15 seconds per move
A5	30 seconds per move
A6	1 minute per move
A7	2 minutes per move
A8	3 minutes per move

The above times are averaged over a large number of moves. In the opening and in the endgame the computer will tend to play faster, but in tactically complicated middle game positions it may take considerably longer on individual moves.

2.3 Tournament levels

Levels B1 to B5 are for tournament play. In these levels the computer will play a certain number of moves in a given amount of time, attempting to meet the so-called "time controls" at certain points in the game. This is exactly what happens in human tournaments. At the time control the arbiter checks to see whether both players have completed the required number of moves. If one of them hasn't, he loses the game.

Level	Description	Primary time control, Secondary time control
B1	Club tournaments	1st 30 moves in 30 minutes, then 30 moves in 30 minutes
B2	International standard	1st 40 moves in 2 hours, then 20 moves per hour
B3	Grandmaster tournaments	1st 40 moves in 2.5 hours, then 16 moves per hour

B4	Fast tournaments	1st 45 moves in 1.5 hours, then 15 moves in 30 minutes
B5	U.S. Open	1st 50 moves in 2.5 hours, then 20 moves per hour

Take Level B2 as an example: the computer will finish the first 40 moves in 2 hours (primary time control) and then play the following 20 moves within 1 hour (secondary time control). All further moves are played at a rate of 20 moves per hour.

In accordance with tournament regulations any time remaining at the primary time control is carried forward to the second phase of the game. If, for instance, the computer has made the first 40 moves on Level B2 in just one hour, it has a total of two hours for its next 20 moves. The remaining time at each time control is accumulated until the end of the game.

Leonardo's built in clocks are running for either Black or White unless you press **STOP**.

Press **STOP** if you plan to leave the board for any length of time.

Otherwise under tournament conditions (levels B or C) Leonardo may play irrationally or instantaneously.

2.4 Special levels

The B-column has three more levels:

Level	Description
B6	10 seconds per move — a special form of speed chess in which both players must make each move in exactly 10 seconds.
B7	Analysis Level — The computer will go on thinking until you interrupt it (by pressing PLAY). You can use this level to have the computer analyse complicated positions for many hours or even days.
B8	Problem solving level (up to mate in 20)

On level B8 the computer searches for a forced mate and will only play a move when it actually finds one. If it does, then it will announce mate and play the key move. You can try to defend for the other side, but the computer will checkmate against any defence.

If the computer does not play a move on level B8, then it means that the problem has no solution (check that you have entered the position correctly), or that it is too long. Theoretically the computer can find mates in up to 20 moves, but solving mates in six or more moves can take very long — hours, or even days.

In section 5.4 of this manual you will find an example for solving a chess problem with the computer.

2.5 Modern tournament levels

A tournament form that is rapidly gaining popularity is one which requires each player to make all his moves in a certain amount of time. This is independent of how many moves are played in the game. If one side runs out of time without checkmating his opponent then he loses the game ("sudden death", as these tournaments are sometimes referred to). The game may be terminated if it is a technical draw (e.g. if there is insufficient material for mate) or if both players agree to a draw.

In levels C1 to C8 the computer will try to complete all the moves of the game in the time specified below. If it is a very long game you will notice that the computer will keep increasing its speed in an attempt to stay within the time allocation.

Level Description

C1	5 minutes for the entire game (Blitz chess)
C2	10 minutes for the entire game
C3	15 minutes for the entire game
C4	20 minutes for the entire game
C5	30 minutes for the entire game
C6	1 hour for the entire game
C7	1.5 hours for the entire game
C8	2 hours for the entire game

2.6 Novice levels

If you are a beginner or an occasional player you may find that the computer is too strong for you on any of the levels described above. It can be very discouraging to get beaten every single time, without ever having a chance to try out simple tactical plans. Children especially can lose interest in the game if there is no element of success.

To meet this problem your Leonardo has eight special novice levels. On the levels D1 to D8 it plays almost instantaneously on each move. With its power thus tamed, even a beginner should be able to win occasionally. Level D1 is the easiest, and the playing strength of the computer increases gradually up to level D8.

2.7 Thinking in the opponent's time

You may have noticed that the computer will sometimes reply to your move instantaneously, even in the middle of a game played on one of the higher levels. This is because the computer was thinking in your time! In all but the novice levels, the computer will try to anticipate the move you are likely to make and to calculate its responses for this move while you are thinking. If it has guessed right there is no reason to go on calculating — so it plays the move it has found immediately.

2.8 Summary of levels

A1	1 sec/move	C1	5 min/game (Blitz chess)
A2	2 sec/move	C2	10 min/game
A3	5 sec/move	C3	15 min/game
A4	15 sec/move	C4	20 min/game
A5	30 sec/move	C5	30 min/game
A6	1 min/move	C6	1 hour/game
A7	2 min/move	C7	1.5 hours/game
A8	3 min/move	C8	2 hours/game

B1	1st 30 moves in 30 min, then 30 moves in 30 min
B2	1st 40 moves in 2 hours, then 20 moves per hour
B3	1st 40 moves in 2.5 hours, then 16 moves per hour
B4	1st 45 moves in 1.5 hours, then 15 moves in 30 min
B5	1st 50 moves in 2.5 hours, then 20 moves per hour
B6	10 seconds per move
B7	infinite (Analysis Level)
B8	Problem solving level (up to mate in 20)

Levels D1 to D8: Novice levels

3. More features

All the things we have seen so far are enough to give you countless hours of pleasure with your Leonardo. You can play straight games against it, correct mistakes and adjust the level of skill to match your needs. But there are many other things the computer can do that make it even more fun to use. This chapter deals with these features individually.

3.1 Changing sides

Would you like to play a game as Black for a change? Just set up the board with the black pieces at the bottom, closest to you. Remember that the black queen must be on a black square and the white queen on a white one. Now press **NEW GAME** and **PLAY**. The computer will make the first move for White, playing down from the top of the board.

Pressing **PLAY** always causes the computer to play the next move. You can change sides with the computer at any time during the game simply by pressing this key instead of making a move. You can do this as often as you like — even press **PLAY** after every move, forcing the computer to play the entire game against itself!

3.2 Interrupting the thought process

The **PLAY** key has another important use: If the computer is spending too long on a move, you can press it to interrupt the thought process. This is very useful on the higher levels, especially analysis level B7, where the computer "thinks forever". Pressing **PLAY** while the computer is thinking always causes it to stop thinking and play the best move it has found so far.

Note: There is one exception to this rule. On level B8 (problem solving), pressing **PLAY** will not cause the computer to play a move. It will only sound a double beep to inform you that it had not found a forced mate when it was interrupted.

3.3 Taking back moves

Normally you are not allowed to take back moves in a serious game of chess. However, if you have committed an unnecessary blunder or when you are analysing a position, it is very handy if you are able to retract one or more moves.

Your Leonardo has a very elegant take back function. Try the following experiment: Play about a dozen moves in a normal game. Then, after the computer has made a move, retract this move on the board (more precisely: lift up the piece that has just moved and then place it on the square from which it came). The board lights will immediately turn red to indicate

that you are in the process of retracting moves and the computer will offer to take back the second-last move. It will show you which piece was moved and, if you lift it up, where it came from.

You can take back as many moves as you like, even to the very beginning of the game (you will get a high-low beep when there are no more moves to take back). When you retract a capture move the computer will remind you to replace the captured piece by flashing the proper square (the piece lights will tell you which piece must go on that square). If you wish to resume normal play at any stage during move retraction, just enter the next move (or press **PLAY** if it's the computer's turn) ignoring the red lights. You can also press **NORMAL** to terminate take back.

There is another way to retract moves. First press **ANALYSIS**. The MODE light turns yellow, indicating that you are in the special "analysis mode" (which we will discuss in detail in the next two chapters). If you now press the key marked $\ominus$ the computer will help you to retract moves exactly as described above. Press **NORMAL** to leave analysis mode and return to normal play (the MODE light turns green).

3.4 Replaying the game

After you have taken back some moves you can play them forwards again. To do so press **ANALYSIS** and then the key marked $\oplus$. The computer will show you which moves were made and you can play through all the moves you retracted. A double beep will tell you when you have reached the last move of the game. To return to normal play, press **NORMAL**.

Note that while you are replaying moves the board lights are yellow. The rule is yellow for forwards and red for backwards (and of course green for normal moves during a game). Try pressing $\oplus$ and $\ominus$ successively in analysis mode.

You can use analysis mode to replay an entire game. Set up the initial position and press **NEW GAME, ANALYSIS** and $\oplus$. The computer will play through the last game with you, move by move. If you want to stop at any stage (e.g. to try a better continuation), just press **NORMAL**. The MODE light turns green and you can play on from the current board position against the computer.

3.5 Entering moves

Analysis mode has one more important use. It allows you to enter moves or force that Leonardo to play a certain continuation. Say you want to try an opening the computer refuses to play of its accord. Press **NEW GAME** and **ANALYSIS**, and then start entering moves for both sides. You will notice that the computer does not try to find counter moves but just keeps track of the moves you play on the board, making sure that all of them are legal. Once you have reached the position you want, press **NORMAL** and play on as usual against the computer.

You can use this feature to enter entire games — e.g. the games from the World Championship Match — and store them in the computer's permanent library (see chapter 6 of this

manual). It is also useful when you are playing a game against a friend and want the computer to act as referee and adviser. Just switch to analysis mode and play the game on the sensor board. The computer will monitor the game, making sure that nobody cheats. And if either side needs help, you can always press **PLAY** and allow the computer to suggest the next move, then **ANALYSIS** to resume as before.

4. Information from the computer

Would you like to know what your electronic chess partner is doing while it is computing a move? Well, your Leonardo will gladly tell you, giving you a wealth of information on its "thought process". It will show you which move it is currently considering, what continuation it expects after that, its evaluation of the position and the depth of its search. This is not just of passing interest — it can help you to learn more about the game.

4.1 The main variation

Try pressing **INFO** while the computer is thinking. It will use the board lights to tell you which move it is considering (the FROM square is turned on for two seconds and the TO square for one second). After that it will show you what it expects you to play on your next move, what it intends to play after that, etc. This is known as the "main variation", the best sequence of moves the computer has found for both sides.

Note that while Leonardo is showing you the main variation it uses yellow board lights. This means that the moves indicated are not yet final — when it has actually decided to make a move you will hear a double beep and the board lights will turn green. Note, too, that the yellow lights on the right (control panel lights 1 — 6) advance with every move. In this way you are always able to tell how deep you are seeing the main variation. Depths over 6 are represented by a blinking 6 control panel light.

4.2 Position evaluation

After showing you all the moves it anticipates, the computer turns on one light (red) to the left of the board to indicate what it thinks of the position from Light 1 (the one nearest the control panel) to Light 8 (furthest away):

- Light 8 — Winning for the player (i.e. the side playing **up** the board)
- Light 7 — Substantial material advantage for the player
- Light 6 — Positional advantage for the player
- Light 5 — Slight general advantage for the player
- Light 4 — Slight general advantage for the computer
- Light 3 — Positional advantage for the computer
- Light 2 — Substantial material advantage for the computer
- Light 1 — Winning for the computer (i.e. the side playing **down** the board)

At the same time the control panel lamps indicate the current depth of the Full-Width Search. The Main Variation is usually at least as deep as this, although on occasion it might be a little less.

4.3 Freezing the Info display

If the information supplied by the computer is coming too fast, you can always "freeze" it by pressing **+**. This will cause the computer to show you only the first move (the one it is considering). Press **+** again to see the next move. You can cycle through the information display manually at any speed you want. Pressing **-** naturally takes you back one step.

So pressing **INFO** and **+** displays only the first move of the main variation. In this state the computer will beep every time it changes its mind. And pressing **INFO** and **-** gives you an instant position evaluation. You can watch the evaluation change as the search progresses (the piece lights tell you how deep the computer is thinking).

4.4 Switching off Info

As soon as the computer has made a move the Info display is switched off. However, when the computer starts thinking again, it is restarted in the same state you left it, i.e. cycling, first move only, or evaluation. Even pressing **NEW GAME** does not change this. If you want to switch the Info display off you must press **NORMAL**.

4.5 An experiment with Info

Press **NEW GAME** and **ANALYSIS**, and then enter the following moves: 1. e2-e4 e7-e5 2. Ng1-f3 d7-d6 3. Bf1-c4 h7-h6 4. Nb1-c3 Bc8-g4. Now set the computer to level A8 and press **PLAY**, **INFO**, and **+**. You can watch how the computer keeps changing its mind until it finds a really good move (5. Nf3xe5!). You should also press **-** occasionally to see how the evaluation changes, or just **INFO** to cycle through the entire variation.

Experiment with the position to find out why the white queen may not be captured after 5. Nf3xe5. If you play 5...Bg4xd1 for Black the computer will immediately show you why it was advocating another move in its main variation.

4.6 Hints from the computer

Even after it has played a move the computer will remember the rest of the main variation and display it if you wish. Just press **INFO** when it is your turn to move. Since the first move the computer displays is the best it has found for your side, you may regard this move as a "hint" from the computer. So if at any time during a game you need advice, just press **INFO**.

Note: When the computer is playing out of its openings library and not actually computing moves, it will not be able to give you any hints. Press **PLAY** if you want the computer to make the next move for you.

4.7 Information while solving problems

On the problem solving level B8 the computer is looking only for a forced mate. Pressing **INFO** while it is thinking will not produce the normal display. Instead, the computer will use red board lights to indicate the current depth of search. If, for instance, the square A1 is displayed ("1" LED flashing, the other on steadily), this means that the computer is currently looking for a mate in one move. A8 means it is looking for a mate in eight (after it has failed to find one in seven or less moves), B1 a mate in nine, B8 a mate in 16, and C4 a mate in 20 (this is the maximum depth the computer will search).

If you press **INFO** after the computer has found (and announced) a forced mate it will show you one of the variations that lead to mate, followed by the number of moves to mate.

Note: The first move is always the key move. The others may in certain cases be a side variation.

5. Verifying and setting up positions

In this chapter you will learn two important things: how to check whether all pieces are correctly located on the board, and how to set up special positions.

5.1 Verifying board position

It may sometimes happen that you have upset the pieces on the board or for some other reason are not sure that the position is correct. In such cases you can always ask the computer to show you the proper location of each piece.

The process is very simple. Just press one of the piece keys. The computer will use the board lights (in red) to show you where that piece is located on the board. Press the same piece key again to find further pieces of the same kind. When there are none left the computer will turn off the board display. You can check other pieces by pressing the appropriate piece keys, in any order you like. To change colors press **TAB/COLOR**. Note that when the computer is showing you white pieces the piece lights are green, for black pieces they are red. Meanwhile the MODE light on the keyboard flashes green. To return to normal play press **NORMAL**.

5.2 How to change the board position

This, too, is very easy. First press **SET UP** to put the computer into set up mode (the MODE light turns red). You can now remove or add pieces at will:

- To remove a piece simply remove it from the board.
- To add a new piece first select the color (by pressing **TAB/COLOR** if necessary). Now press the appropriate **PIECE KEY** and place the new piece on the empty square.

Make sure that the WHITE or BLACK lights correctly indicate the side to move next before you return to normal play by pressing **NORMAL**.

Try the following experiment: Press **NEW GAME** and **SET UP**. Now remove the black Queen from the board. Press

NORMAL. The familiar new game signal (low-high-low-high) will tell you that the computer has accepted the position. It will play the game without its queen (this is known as a "queen-odds" game). Try adding a second black king to the position. When you press **NORMAL** you will hear an error beep (high-low) indicating that the computer does not accept the illegal position.

5.3 Setting up a special position

To set up a special position which contains only a few pieces, it is better to start from scratch. Press **NEW GAME, SET UP** and then **FUNCTION, NEW GAME**. This clears the board of all pieces. You can now enter the position as described above.

Example: To set up a "white to move" position with white King on E1, white Rook on A1, black King on D5, and black Rook on B2, first press **NEW GAME, SET UP, FUNCTION, NEW GAME** to clear the board. Press **TAB/COLOR** (if necessary) to turn the WHITE light on. Press the **KING** Key and then place the white King on its square. Press the **ROOK** Key and then place the white Rook on its square. Now press **TAB/COLOR** (BLACK light on) and then place the black Rook on its square. Press the **KING** Key and then place the black King on its square. Press **TAB/COLOR** (WHITE light on = White to move) and **NORMAL** to return to normal Play Mode.

Note: In the above position the computer will permit castling. If you press **PLAY**, it will castle and capture the black Rook on the next move!

5.4 Chess problems

Your Leonardo has a special problem mode (level B8) in which it will solve chess problems up to mate in 20 moves.

Here's an example:

Problem by William A. Shinkman
White to play and mate in 3 moves



Enter this position as described in the last sections (**NEW GAME, SET UP, FUNCTION, NEW GAME, KING** Key, place the white King on D3, **QUEEN** Key, white Queen on F7, **KNIGHT** Key, white knight on C7, **TAB/COLOR, KING** Key, black king on E5, **TAB/COLOR, NORMAL**).

In this position White has an overwhelming material advantage and there is no doubt that he can easily mate the black King. But whereas in chess the ultimate aim is to checkmate the opponent, the goal in chess problems is to checkmate the opponent in a given number of moves!

The problem requires that White mate on his third move at the latest, against any defence by Black. The solution is not easy to find and, unless you are an experienced problem solver, you may not find it at all. For the computer it is trivial. Set level B8 and press **PLAY**. In just a few seconds it will show you the startling solution: 1. Nc7-a8!, the only move that leads to mate in three. You can try to defend the position for Black by entering moves as usual. The computer will continue playing the checkmating side until the game is over. Or you can just press **INFO** to obtain one of the checkmate variations (1...Ke5-d6 2. Kd3-d4 Kd6-c6 3. Qf7-d5 mate).

Chess problems such as the above are generally found in newspapers and magazines and usually adhere to certain fixed conventions. Unless otherwise stated, the problem will always require White to play and deliver mate in a certain number of moves against any defence Black may put up. The caption to the diagram may be as in our example, or it may simply say "Mate in three" or "Mate in four".

6. The programmable library

Your Leonardo has some memory features that are quite exceptional in the chess computer world. As we have seen (in section 1.8) it remembers the board position and the entire game even when you switch it off by pressing **STOP**. You can resume play exactly where you left off, weeks or even months later. But it is the built-in programmable library that makes this computer truly unique.

6.1 Storing a game in the library

Let us assume you have just finished playing a fine game against the computer and think you might want to take another look at it later. Well, then store it in the computer's programmable library! First press **LIBRARY** to get into library mode. The MODE light and two board lights will flash (all in red). The computer is offering you a memory "slot" for the game. If you have not yet stored any games, it will be flashing the square A1. Press **FUNCTION, +**. The board lights will turn steady to indicate that the computer has stored the game in slot A1. Press **NORMAL** to exit library mode.

You can store not only the games you play against the computer but also ones you input manually (see section 3.5). You can also store special openings, positions, or chess problems, including their solutions. Whatever you put into a memory slot is stored permanently and will not be lost even when you switch the computer off.

6.2 The memory banks

When putting a game into the programmable library, you do not, of course, have to accept the memory slot the computer is offering you. Using $\oplus$, $\ominus$ and **TAB/COLOR** (in library mode) you can choose any of the 64 squares of the chessboard to store your game. Just make sure the slot you are using is empty, i.e. that the red board lights are flashing.

The computer can store a total of 4,000 moves — which certainly adds up to a lot of games. To make it easier for you to classify and keep track of them, there are six memory “banks”.

When you first pressed **LIBRARY** you may have noticed that the King light was turned on (in yellow). This meant that you were in bank 1 (or the “King’s bank”). By pressing **FUNCTION** and one of the other **PIECE KEYS** you can switch to any of the other five banks. Each has 64 slots of its own, which adds up to six times 64 slots. However, the very last one — H8 in the pawn bank — is reserved for internal use by the computer, so that you can store games in a total of 383 slots.

You will appreciate this system when you begin storing large numbers of games and positions. You might put the games you play against the computer in the King’s bank, famous games in the Queen’s bank, chess problems in the Bishop’s bank, etc. Or if you want to build up an extensive openings library (see section 6.4) you might store all king-pawn openings in the King’s bank, queen-pawn openings in the Queen’s bank, etc. It is advisable to keep a note of where you store anything, e.g. “Queen’s bank, E1: First game of the 1985 World Championship Match between Kasparov and Karpov”.

6.3 Retrieving games

So how do you recover a game that you have stored in the library? First press **LIBRARY** and then, if necessary, **FUNCTION** and a **PIECE KEY** to get into a specific memory bank. Now use **TAB/COLOR**, $\oplus$ and $\ominus$ to go to the slot you want. The board lights should be steady to indicate that there is actually a game stored there. Press **FUNCTION** and **NEW GAME**. This loads the game into current memory and you can play through it by pressing **ANALYSIS**, $\oplus$.

There is another way to find a game in the library. Say you remember the first few moves of a game you want to retrieve. Enter these moves in analysis mode and then press **LIBRARY**. The computer will look for the game that contains these moves and show you the bank where it is stored. Press **NORMAL** and the rest of the game is copied into current memory. You can play through it by pressing **ANALYSIS**, $\oplus$.

If there is more than one game that matches your moves, then the computer will keep pointing to game slots each time you press **LIBRARY**. After the last game it will offer you a free slot (flashing board lights) for the moves you have entered. Press **LIBRARY** again to return to the first matching game.

The above, of course, also applies to positions and chess problems. If you set up and enter a position and then press **LIBRARY** the computer will check to see if the position is already in the library. If it is, the board lights will be steady, and you can press **NORMAL** (or **FUNCTION, NEW GAME**) to copy the moves into current memory. If the computer cannot find the position, then it will offer you a slot (flashing board lights) in which you may store it for future use (press **FUNCTION**, $\oplus$ to do so).

6.4 Storing active openings

As we have just seen, you press **FUNCTION**, $\oplus$ to store a normal game or sequence of moves. Pressing **FUNCTION**, **TAB/COLOR** instead also stores the game, but with an important difference: The game becomes part of Leonardo’s openings library! This means that the computer will play the moves of its own accord during normal games.

This function is principally used to extend the computer’s built-in openings library. Try the following experiment: Enter the moves 1. e2-e3 e7-e5 2. Bf1-c4 Nb8-c6 3. Qd1-h5 Ng8-f6 4. Qh5xf7 mate and then press **LIBRARY**, **FUNCTION**, **TAB/COLOR**. If you now start a new game with the move 1. e2-e3 the computer will play the above sequence of moves, allowing you to mate it in four moves. This is a mean trick to play, but it serves to illustrate how you can store openings that become active in normal play.

6.5 Deleting games

You will probably want to delete the above “opening” as quickly as possible. Or you have filled up the computer’s memory completely — that should take you quite a while! — you are unable to store any more games (you will get an error signal if you try). So you must delete some that are no longer of interest. Or perhaps you will want to “tidy up” occasionally and get rid of some of the games you have stored. To do so, go into library mode, choose the memory slot of the game you wish to delete, and then press **FUNCTION**, $\ominus$. The board lights will start to flash, indicating that the slot is now empty.

A formula for calculating how many individual moves you can store:
 $5120 - 5 \times (\text{individual moves in current game}) - 32 \times (\text{set up positions in library}) - 2 \times (\text{games or variations in library})$
e.g.: Your current game is 45 moves long (each of 2 individual moves), you have 30 games in library and no set up positions. Then your library capacity is
 $5120 - 5 \times 2 \times 45 - 32 \times 0 - 2 \times 30 = 4610 \text{ individual moves!}$

6.6 Things to remember

Here's a short summary of the commands in Library Mode:

- LIBRARY** — enter library mode (MODE light flashes red)
FUNCTION, PIECE KEY — choose bank
TAB/COLOR / ⊕ / ⊖ — choose memory slot

If the board lights are flashing then the slot is empty, if they are steady then there is a game in the slot.

- FUNCTION, ⊕** — copy the current game or position into that slot.
FUNCTION, TAB/COLOR — copy the current game into that slot and make it part of the computer's openings library
FUNCTION, NEW GAME — make the game stored in that slot the current game
FUNCTION, ⊖ — delete game stored in that slot
NORMAL — return to normal play

If you have made some moves in a game or entered a special position:

- LIBRARY** — search for a game that matches the moves or the position
NORMAL — add the rest of the moves to the current game

7. Communication with a Personal Computer

7.1 Introduction

Leonardo breaks loose from its physical confines and can link directly to the outside world. Using the **OSA Link** you can connect Leonardo (plus upgrade modules if installed) directly to a printer, a P.C., a supermini, or even a mighty mainframe. Two way communication is possible to provide boundless facilities.

Just imagine! Here are some of the things Leonardo can do.

Linking to a printer only: You can immediately get a continuous print out of your game, the time taken per move, take backs made, position shown graphically, and total time taken by both sides (see Appendix I).

Linking to a personal computer: You don't need to be a skilled programmer to soon discover even more information that can be obtained using Leonardo linked to a personal computer. See Leonardo's analysis of each main line continuation while it is thinking and its rating of the end position. Leonardo will help you improve your game by showing alternative winning combinations that you may have missed. Using your own personal computer program the opportunities are endless. Why not program Leonardo to analyse one of your games over a weekend? Ask it to think for an hour (or longer) over each move in turn and then print out all the moves with a position evaluation and main line continuation alternative. That way you can see at what point the game was won or lost. You can even connect Leonardo to a modem and exchange chess information with chess players worldwide.

7.2 Languages

Leonardo's built-in programs understand English, German, French, Dutch, Spanish, Italian and Swedish. The three programming languages are:—

- A) **BOSAL** — Basic Open Systems Architecture Language
B) **MOSAL-A** — Machine Open Systems Architecture Language (ASCII)
C) **MOSAL-B** — Machine Open Systems Architecture Language (Binary)

BOSAL is the easy-to-use, powerful language for all users. Anything you can do on the Leonardo keyboard can be remotely controlled by **BOSAL**. From the depths of Leonardo you can access the high-precision evaluation, log all INFO as Leonardo thinks, list the game or any position at any time. Adjust the clocks. Set the level. Change to another of the 7 built-in foreign languages. These and many other functions are assisted by the built-in Help function.

If you are an advanced programmer you will want to plunge deeper and faster with the 2 related languages **MOSAL-A** and **MOSAL-B** (Machine OSA Language, ASCII/Binary). These allow more detailed interaction with all aspects of Leonardo. With **MOSAL-A** you can exercise your control directly from the keyboard in ASCII. **MOSAL-B** works twice as fast: it has the same formats, but sends them in packed byte form.

7.3 Equipment needed

All computers with an RS-232C interface can be linked to Leonardo.

(e.g. IBM, Apple, Schneider/Amstrad). A special RS-232C Adapter I is available through your Leonardo stockist. (see Fig.3).

The Commodore 64 requires a **C64** connecting cable also available through your stockist. (see Fig. 4).

The Leonardo can also be connected directly to any RS-232C interface printer without needing any computer intermediary. It can be a portable typewriter/terminal such as the Brother EP-44, Brother 1109 or a computer printer like the Epson FX-85, equipped with serial interface.

7.4 Where to obtain your OSA guide

If you are interested in linking this ultimate chess computer to your personal computer, you should obtain the Advanced OSA Programmer's Guide. This guide will be supplied to you with the purchase of one RS-232C Adapter I (article # 590) or one **C64** connecting cable (article # 591). Please ask your Kasparov stockist.

8. Some technical details

8.1 Changing the batteries

Weak batteries should be replaced promptly as they might leak and cause damage to the computer. One set of batteries will give you about 150 hours of play. When batteries are low the computer will start to beep, once every second, until you press a key. This happens several hours before the batteries actually expire, so you have ample time to remedy the situation.

If you have stored games in the user-programmable library (see chapter 6), then you should take some precautions when changing batteries. First switch the computer off by pressing **STOP**. Have the **new set of batteries ready** and then **exchange the first pair of batteries on the left as quickly as possible**. You can easily do so in less than 20 seconds. This ensures that the contents of the library are not lost. Then you exchange the second pair of batteries.

8.2 The mains adapter

If you use the mains adapter then you should take the following precaution to ensure that the contents of the user-programmable library are not lost. Whenever attaching the adapter, press **STOP** to make sure that the computer is switched off. Connect the adapter first to the mains and then to the adapter socket of the computer.

It is recommended that the batteries are left installed in the Leonardo even when using the adapter. This will retain the stored games if the power supply is interrupted.

8.3 The ACL key

If the computer locks up because of static discharge or some other reason, press **STOP** and then use a paper clip or some other sharp object to press the ACL key to the right of the keyboard for one second. This resets the computer. It also clears the memory, so the contents of the User-Programmable Library are lost.

8.4 How to adjust the door

Should the door become misaligned through abnormal changes in temperature or humidity, then it can be adjusted using the spacers as shown in Fig. 2, diagram B.

8.5 Care and maintenance

Your Leonardo is a precision electronic device and should not be subjected to rough handling or exposed to extreme temperatures or moisture. Do not use chemical agents to clean the set as these may damage the wood.

8.6 Technical specifications

Microprocessor:	6301Y
Processor speed:	12 MHz
Program memory:	24 Kbytes
RAM memory:	8.25 Kbytes
Memory retention:	2 years (fresh alkaline batteries)
LED lamps:	6 red, 23 triple-color
Keys:	21
Power consumption:	0.3 W (excl. module)
Battery requirement:	4 "C" cells (type AM2/R14)

Battery life:	150 hours (alkaline batteries)
Battery low warning:	4 hours minimum
AC adapter:	7-9V DC at 300 mA minimum with 2.1 mm ID / 5.5 mm OD plug
Dimensions:	520 x 520 x 50 mm
Weight:	4.8 Kg (without batteries)

8.7 Troubleshooting guide

SYMPTOMS	POSSIBLE CAUSES	WHAT YOU SHOULD DO
1. The computer does not work with batteries	Batteries not inserted properly	See Fig. 1
	Power reset problem	Press ACL key (see section 8.3)
2. The computer keeps beeping, does not play moves	Batteries weak or bad	Replace batteries (see section 8.1)
3. Computer does not work on adapter	Wrong adapter type, voltage rating, etc.	Check with dealer
	Defective adapter	If the computer works on batteries but not with the adapter then the latter is probably defective. Send it to the service centre.
4. Lamps light up together, the computer behaves erratically or "freezes" in the middle of a game	Power on reset problem, static discharge or mains disturbance	Unplug adapter, take out batteries, press ACL key, check mains connection (both adapter plugs fit snugly), reinstall batteries and switch on again. (See section 8.3)
5. Lamp, key or chessboard square does not work	Defective component or contact	Consult your service centre
6. Computer cheats or makes illegal moves	It has made a special move like — En passant — Castling (king or queen side) — Pawn promotion/underpromotion	Make sure you are familiar with the chess rules (read the "Rules of Chess" manual). Use the piece keys to check the current board position (see section 5.1), then take back a move and check the previous board position. This will tell you exactly what the computer has done.
	Your board position is not correct, some pieces have been displaced	Verify the board position (see section 5.1)
7. The computer refuses to accept a move	You are trying to make an illegal move	Is it your turn? (look at the color lamps) Is your King in check? (CHECK lamp) Is the game over (checkmate or draw)? Will your move put your King into check? Are you trying to castle incorrectly? (check the rules) Did you move the Rook first when castling? Is one of the pieces displaced? (flashing lights for that square)
8. A pawn moves like a Queen (or Rook, Bishop or Knight)	The pawn has been promoted	Use the piece keys to confirm the board position. Take back moves until before the promotion and allow the computer to make the move again
9. The King moves like a Queen	King and Queen were swapped around in the initial position	Use piece keys to confirm the identity of the pieces
10. Computer will not reply to your moves	You are in Analysis Mode (see chapter 3)	Press NORMAL and then PLAY
	The computer is still thinking (color light flashing)	Press PLAY to interrupt (see section 3.2) Level B7 (analysis) or B8 (problem solving) is set (see section 2.4) Verify the level
11. The computer is silent	The sound is off (see section 1.7)	Press SOUND to turn it on again
12. The computer won't store a game	The memory slot is occupied (see section 6.2)	Clear the slot (see section 6.5) or choose another slot
	The library is full	Delete unimportant games (see section 6.5)
13. Computer makes instant or irrational moves.	Excess time has been accumulated by computer's side.	Press STOP whenever you leave Leonardo for any length of time to stop the internal clocks.

Appendix I

1. d2-d4	00:03	d7-d5	00:03
2. c2-c4	00:02	e7-e6	00:03
3. Nb1-c3	00:02	c7-c5	00:03
4. Ng1-f3	00:09	Ng8-f6	00:09
5. Bc1-g5	00:04	d5xc4	00:24
6. e2-e4	00:08	c5xd4	00:12
7. Nf3xd4	00:03	e6-e5	00:06
8. Nd4-c2	00:26	Bd8xd1+	00:13
9. Ra1xd1	00:04	Bc8-g4	00:07
10. f2-f3	00:07	Bg4-e6	00:03
11. Nc2-e3	00:08	Bf8-b4	00:04
12. Bf1xc4	00:16	Be6xc4	00:11
13. Ne3xc4	00:04	Nb8-c6	00:03
14. a2-a3	00:50	Bb4xc3+	00:08
15. b2xc3	00:02	O-O	00:08
16. Bg5xf6	00:01	g7xf6	00:08

>POSITION

```

r - - - - r k -
p p - - - p - p
- - n - - p - -
- - - - p - - -
- - N - P - - -
P - P - - P - -
- - - - - P P
- - - R K - - R

```

> 17. Nc4-d6	00:33	b7-b6	00:07
18. Nd6-f5	00:11	Ra8-d8	00:08
19. O-O	00:02	Rf8-e8	00:06
20. c3-c4	00:22	Nc6-d4	00:09
21. Nf5xd4	00:16	Rd8xd4	00:06
22. Rd1xd4	00:03	e5xd4	00:16
23. Rf1-d1	00:09	Re8-d8	00:03
24. g2-g4	01:02	d4-d3	00:06
25. Kg1-f2	00:01	f6-f5	00:13
26. g4xf5	00:05	Rd8-d6	00:14
27. Kf2-e3	00:04	Rd6-h6	00:03
28. Rd1xd3	00:04	Rh6xh2	00:06
29. Rd3-d2	00:31	Rh2xd2	00:13
30. Ke3xd2	00:02	h7-h5	00:03
31. Kd2-e2	00:01	h5-h4	00:05
32. Ke2-f2	00:01	Kg8-g7	00:08
33. Kf2-g2	00:01	Kg7-f6	00:08
34. Kg2-h3	00:01	Kf6-g5	00:06
Takeback		Takeback	
34. f3-f4	00:02	Kf6-e7	00:13
35. e4-e5	00:06	f7-f6	00:05
36. e5-e6	00:01	Ke7-d6	00:13

Appendix II

42. e3-e4 00:17
 Sendinfo = 00:00 1 +00909 c7-d5 c4-c8
 Sendinfo = 00:01 1 +00137 d6-e5
 Sendinfo = 00:01 2 +00137 d6-e5
 Sendinfo = 00:02 2 +00157 d6-e5 a3-a4
 Sendinfo = 00:02 2 +00156 b6-b5 c4-d4 d6-e5
 Sendinfo = 00:03 2 +00155 a7-a6 a3-a4
 Sendinfo = 00:03 3 +00155 a7-a6 a3-a4
 Sendinfo = 00:05 3 +00177 a7-a6 f4-d5 b6-b5
 Sendinfo = 00:05 3 +00156 b6-b5 c4-d4 d6-e5
 Sendinfo = 00:06 4 +00156 b6-b5 c4-d4 d6-e5
 Sendinfo = 00:09 4 +00161 b6-b5 c4-d4 d6-e5 d4-d7
 Sendinfo = 00:16 5 +00161 b6-b5 c4-d4 d6-e5 d4-d7
 Move Ready 00:18

b6-b5 00:20

43. Rc4-c5 00:05
 Sendinfo = 00:00 1 +00927 c7-d5 c5-c8
 Sendinfo = 00:01 1 +00338 f6-f5 e4-f5
 Sendinfo = 00:01 1 +00164 d6-d7
 Sendinfo = 00:02 1 +00142 a7-a5
 Sendinfo = 00:02 2 +00142 a7-a5
 Sendinfo = 00:03 2 +00147 a7-a5 f4-d5
 Sendinfo = 00:03 3 +00147 a7-a5 f4-d5
 Sendinfo = 00:08 3 +00201 a7-a5 c5-f5 a5-b4 f5-f6 d6-e5
 Sendinfo = 00:12 3 +00183 c8-b8 f4-d5 c7-e6
 Sendinfo = 00:13 4 +00183 c8-b8 f4-d5 c7-e6
 Sendinfo = 00:26 4 +00178 c8-b8 f4-d5 c7-e6 c5-c3
 Sendinfo = 00:32 5 +00178 c8-b8 f4-d5 c7-e6 c5-c3
 Move Ready 00:33

Rc8-b8 00:35

POSITION

- r - - - - -
 p - n - - - - -
 - - - k - p - p
 - p R - - - - -
 - P - - - P N - -
 P - - - - K - -
 - - - - - p p
 - - - - - - -

>CLOCKS

Clocks = 14:06 37:30 00:13

Playing against a Kasparov chess computer is an ideal way to learn the skills of chess and improve your game. There are many good books written on chess and the following are some we recommend:

'HOW TO GET THE MOST FROM YOUR CHESS COMPUTER'

by Julio Kaplan

R.H.M. Press

'CHESS OPENINGS (BCO)'

by Garry Kasparov & Raymond D. Keene

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